PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements relating to Hypodermic Injection apparatus

I, AUGUSTE ROOSEBOOM, a citizen of the United States of America, of Suite 1003, Ten Rockefeller Plaza, New York City, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a structurally and functionally improved hypodermic syringe and ampoule assembly.

It is a primary object of the invention to provide new or improved means for actuating a hypodermic needle support to cause the said needle to be projected beyond the body of the apparatus. A further object is to provide a hypodermic syringe and medicament container assembly such that in response to manual release or firing of the mechanism, the epidermis will be penetrated by a needle, medicamant will be injected through the bore of that needle, and the needle will be automatically withdrawn, in a highly desirable and improved manner.

Another object is that of designing a hypodermic syringe which may be readily loaded with or receive an ampoule filled with proper medicament and in which the mechanism of the syringe may be easily potentialised to perform the desired sequence of operations as stated above.

According to the invention a hypodermic needle and a medicament-containing member are operatively connected with each other mounted on supports within and movable with respect to the body of the apparatus, power means supported by the body being connectable with the said supports by a coupling assembly including clutch mechanism for moving the supports to cause the said needle to project beyond a predetermined point, and releasable means being provided for preventing the said movement of the supports.

In order that the invention may be clearly understood and readily carried into effect, apparatus constructed according to the invention, together with modifications, will now be more fully described, by way of example only, with reference to the accompanying drawings, in which:—

Figure 1 is a sectional side view of the apparatus and showing the same in completely assembled condition;

Figure 2 is a view similar to Figure 1 with the cap removed and the parts initially projected;

Figure 3 is a fragmentary sectional view similar to Figures 1 and 2 but showing the the mechanism at substantially the completion of the injection stroke;

Figure 4 and 5 are fragmentary side elevations showing exterior casing portions turned through substantially 90° with respect to each other;

Figures 6 and 7 are transverse sectional views taken along the line 6—6 and 7—7 respectively and in the direction of the arrows as indicated in Figure 1;

Figure 8 is a sectional side view of an ampoule unit such as may be employed in this assembly;

Figure 9 is a view similar to Figure 1 but showing an alternative construction;

Figure 10 is a sectional side view similar to Figures 1 and 9 but showing a still further construction;

Figure 11 also corresponds to Figures 1, 9 and 10 but is illustrative of an additional alternative, and

Figures 12 to 15 inclusive are sectional side views of ampoules involving alternative designs.

Referring to the drawings, primarily to Figure 1, there is indicated at 20 a housing cap which encloses a nose piece 21 and which has a screw threaded connection at 22 with a sleeve 23. The latter carries the nose piece 21 again by way of example through screw threads. The rear end of the sleeve 23 en-

[*Price 3s. 0d.*]

closes a body 24 which is secured against movement with respect thereto by, for example, a set screw 25 and any additional or auxiliary securing means which may be desirable.

The nose piece 21 is conveniently formed adjacent to its outer end with a centrally disposed recess 26. Extending forwardly into the latter is a hypodermic needle 27, the main portion of which is normally housed within the nose piece 21 and the sleeve 23. The rear end of this needle is secured to or connected with a hub 28 which is in turn mounted on the forward end of a stem 29. The stem 29 is bored as indicated at 30, and this passage preferably communicates with and is aligned with the bore of the needle 27. The stem 29 is conveniently notched as at 31. A plate 32 is in line with and encircles the notched portion 31, the plate 32 being spring pressed as at 33 and terminating in an actuating portion 34^1, the outer surface of which is conveniently roughened or serrated. It is apparent that when the parts are in their normal position as shown in Figure 1, the plate 32 riding within a slot formed in the body 24 will bear against the side of the notch 31 and thus prevent any axial movement of the stem 29 with respect to the sleeve 23.

A second sleeve 34 is disposed to the rear of the sleeve 23 and is connected thereto in a manner hereinafter described. This sleeve 34 has its rear end closed and is provided with a spring 35 which has its rear end bearing against the closed rear end of the sleeve, and its forward end acting against the forward flange of a chuck or ampoule-receiving member 36. The member 36 has its rear end preferably constricted as at 37 to provide a guiding portion for engagement with the surface of an ampoule. The chuck is formed with openings across which an annular series of springs 39 extend, and these springs carry pawls 40 at their outer ends. As shown in Figure 1 the pawls 40 engage to the rear of a bead 41 formed at the forward end of an ampoule 42. The ampoule has its rear end closed, and it contains medicament, and its forward end is obstructed by a piston type stopper 43.

This stopper 43 is provided with a bore 44 and its outer face may be formed with a seat to receive the reduced end portion of the stem 29 with the bore 30 of the latter aligning with the bore or opening 44 of the stopper. Adjacent to the reduced rear end of the stem 29, a plunger portion 45 is mounted. This plunger portion may be formed with longitudinally extending slots pivotally mounting as at 46 a plurality of dogs 47. The latter normally occupy positions in which they extend beyond the surface of the plunger head 45, being urged outwardly by means of springs (not shown).

A spring 48 encircles stem 29 and has its opposite ends bearing against the opposed faces of the plunger head 45 and the body 24. Extending from the body 24 and conveniently integral therewith, is a tube 49, which is concentrically disposed with respect to the stem 29 and defines a space such that plunger head 45 may be accommodated within its bore. So accommodated, the dogs 47 will be engaged by the rear edge of tube 49 in a cam action and be swung to retracted position where their outer edges are substantially co-extensive with the adjacent surfaces of the plunger head 45. The resistance value of the spring 48 is substantially less than that of spring 35. It is to be understood that the expansive force exertable by the spring 35 is sufficient to project the chuck 36 and the parts associated therewith to a point adjacent to the rear wall or face of the body 24 and to fully compress the spring 48.

A collar 51 connects the sleeves 23 and 34, the collar 51 having an internal diameter such that it may accommodate the adjacent ends of the said sleeves. The body 24 may abut an inwardly extending flange 52 forming a part of the collar 51. As previously stated this body portion is retained against movement with respect to the sleeve 23 by securing elements such as 25. The collar is formed with any desirable number of spirally extending slots 53 and 54 to accommodate a corresponding number of securing elements. In order to avoid unnecessary complication in the illustration, only a single pair of these slots have been shown. As will be noted, they are opposed to each other and the slot 53 extends through to the edge of the collar 51. The forward edge of the sleeve 34 presents an outwardly bevelled surface as at 55. Rearwardly of that edge, this sleeve mounts one or more securing elements 56, and as shown especially in Figure 5 this securing element rides with the slot 54.

Thus it is obvious that by rotating the collar from the position shown in Figure 4 to a position at which the securing element or bolt 25 is in line with the outer end of the slot 53, the casing section or sleeve 34 may be detached from the sleeve 23. Under these circumstances, the collar 51 will remain attached to the sleeve 34. Conversely, if the securing element 25 is aligned with the open end of slot or slots 53 and the collar 51 is rotated in a reverse direction, the pin or bolts 25 and 56 will cam against the edges of the slots to draw the sleeves towards each other. This action will continue until the sleeve 23 and the parts associated therewith are telescoped to a maximum extent within the collar 51. Under those conditions, the flange 52 will lie adjacent the rear face of the body 24 and the bevelled edge 55 of the sleeve 34 will be spaced from the flange 52 With the cap 20 enclosing the nose piece 21, the rear edge of said cap will intervene the

sleeve 23 and the extended actuating portion 34[1] of the latch 32. Therefore, that latch may not be released to bring its opening to a position at which the stem 29 may pass therethrough. Therefore, the stem 29 will be retained against movement with respect to the parts therein.

Considering the operation of this mechanism, it will be assumed that the parts are assembled and in the positions shown in Figure 1, and that the ampoule 42 is filled with medicament. If now the cap 20 is removed from the sleeve 23, the nose piece 21 will be exposed and the recess 26 of the latter can be disposed above the surface of the tissue to receive the injection. With removal of the cap, the latch may be released. This is achieved by pressing against the actuator portion 34[1] to shift the plate 32 to a position at which its orifice is concentrically disposed with respect to the surface of the stem 29. Under these circumstances, the spring 35 which is under compression will be free to expand because of the release of restraint against the stem 29.

As the spring 35 expands, it will shift the chuck 36 to the left as viewed in Figure 1. This will be because the forward end of the spring bears against the flange portion 38 of the chuck 36. The latter, together with the contained ampoule, will move in unison because the inner ends of the pawls 40 bear against the bead 41 of the ampoule by reason of the inward pressure exerted by the springs 39 extending through the slots in the forward end of the chuck assembly. The pressure exerted by the spring 35 will also be transmitted to the stem 29 because of the dogs 47 which bear against the forward edge of the ampoule. It follows that the needle 27 will be projected beyond the nose piece, and with the parts properly proportioned that projection will result in a penetration of tissues to the desired depth. This position of the parts has been shown in Figure 2.

Also there has been illustrated in the view the fact that the dogs 47 have cammed against the rear edge of the tube 49 so that these elements are retracted with respect to the actuating head 45, and therefore no longer bear against the outer edge of the ampoule. Incidentally it will be noted in this view that the spring 48 has now been fully compressed incident to the shifting of the parts from the position shown in Figure 1 to that illustrated in Figure 2. In any event, with the ampoule assembly free to move with respect to the actuating head 45, the latter will cause the piston stopper 43 to shift rearwardly within the ampoule body. This will result in the liquid medicament within the ampoule being expressed through the bore 44 of the stopper 43 and the bore 30 of stem 29, as well as the bore of the needle 27. The needle 27 having reached its maximum depth of tissue-penetration, it follows that the medicament will be injected, and this action of the parts will continue until the piston stopper 43, under the influence of the spring 35, reaches a position substantially fully retracted within the body of the ampoule 42. This has been shown in Figure 3.

It will be observed in Figure 3 that the pawls 40 have ridden in contact with the bevelled edge portion 55 of the rear sleeve 34 and moved outwardly under the action of the springs 39. This will have caused the inner portions of the pawls to move from positions to the rear of bead 41 of the ampoule. In other words, the clutch structure which has heretofore been operative to maintain the ampoule in a forward position within the chuck will now become inoperative. Therefore, while the chuck assembly will remain in the projected position shown in Figure 3, the stem 29 and ampoule 42, as well as the parts included in these assemblies, will under the urging of the spring 48 move rearwardly. This rearward movement will continue until the stem 29 has reached its fully retracted position. Under these circumstances, the needle 27 will be completely withdrawn from the tissues. Also, the latch plate 32, under the action of the spring 33, will have shifted to a point at which the notch 31 of the stem accommodates the adjacent plate portions. It follows that no further shifting of the stem and its associated parts will occur with respect to the sleeve 23.

The operator, by now turning the collar 51 to a position at which the bolt or other projection 25 may be withdrawn from the slot 53, will be able to separate the sleeve 34 from the sleeve 23. Under these circumstances, the chuck structure will be exposed so that the spent or discharged ampoule may be withdrawn and discarded. A fresh ampoule is now positioned within the chuck. With the latter shifted rearwardly so that the pawls 40 are beyond the bevelled surface 55, these pawls will engage to the rear of the ampoule bead 41, as shown in Figure 1. It is to be remembered that the stem 29 is maintained in retracted position. Therefore, the operator in reassembling the parts will bring the actuating head 45 to a position in line with the piston stopper 43. So aligned, the dogs 47 will bear against the bead 41 and by telescopically disposing the sleeve 23 with respect to the collar 51, the stem 29 will force the chuck rearwardly to a position at which the spring 35 is properly compressed. As the collar 51 is rotated through its final stages, to lock the parts, the camming action exerted by the slots 53 and 54 will cause a slight retractive movement on the part of the piston 43 until further shifting is arrested by the dogs 47 engaging the bead 41. That slight movement will cause liquid medicament to pass through the bores 44, 30 and the bore

of the needle so that air will be evacuated from these passages. With the cap 20 again applied in position, the relationship of the parts will be re-established, and the apparatus will be ready for a second operation.

As will be understood, the specific configuration of the ampoule might be varied in numerous particulars and its capacity also may be varied. Preferably the parts of this assembly are properly sterilised and the medicament is placed within the body of the ampoule in sufficient quantity to provide the desired dosage. Thereafter, the piston stopper 43 is disposed adjacent to the open mouth of the ampoule. The sterility of the parts is maintained by providing, for example, a cap or protective layer 57 of any suitable material which overlies the face of the stopper 43. It is apparent that prior to placing the ampoule in association with the chuck, this protective strip or cap is removed and discarded. It will also be apparent that the ampoule may be formed of any desired material such as glass and that the stopper thereof is preferably formed by a synthetic or natural rubber. Likewise the several parts of the injecting mechanism may be formed of any desired materials such as suitable metals and/or plastics.

In Figure 9 an apparatus has been illustrated which largely follows the structure shown in Figures 1 to 7. For this reason, similar reference numerals have been used to designate corresponding parts. However, as will be seen in this figure, the structure of the chuck 58 has been modified in comparison with the structure of the chuck 36. More particularly, instead of being provided with longitudinally extending openings through which springs 39 and pawls 40 extend, the chuck 58 is formed with an annular series of openings within which balls or spheres 59 are disposed. These openings may be constricted adjacent to their inner ends to retain the balls. These spheres bear against the outer surface of the ampoule and the inner bore surface of the sleeve 34. The rear end of the stem 29 is tapered and is reduced as indicated at 60 to extend through the enlarged bore of the piston stopper 61. In advance of that stopper, a plate 62 formed with an opening of a diameter adequate to accommodate the reduced end portion of the stem is provided. Therefore, when the stem has penetrated the stopper to the position shown in Figure 9, further relative movement in a rearward direction is prevented. Also, in lieu of the actuating head 45 and series of dogs 47, a plurality of swinging arms or pawls 63 are provided to bear against the outer edge of the ampoule.

As will be appreciated, the operation of the parts is substantially identical with that heretofore described. Briefly summarized, the main spring will project the chuck and ampoule carried thereby from the position shown in Figure 9 to a position at which the needle has penetrated the tissues to the desired depth. At that moment the spring arms 63 will cam against the rear edge of the tube 49 and be swung to retracted positions such that they may enter the tube. So retracted, the pressure of the main spring will be free to project the ampoule with respect to the stopper 61 which will cause expulsion of the medicament. At the end of this stroke, the clutch structure provided by the spheres 59 will become inoperative because these spheres or balls will have over-ridden the bevelled edge 55. Therefore, the ampoule will be disconnected from the main spring and incident to the action of the spring 48 will shift rearwardly as a unit with the stem 29 to cause withdrawal of the needle from the injected tissues.

Now referring to the structure illustrated in Figure 10, it will be seen that the numeral 64 indicates a nose piece to which a cap 65 may be applied. This nose piece conveniently carries pins or projections 66 co-operating with the slots formed in the collar 67, further slots in that collar co-operating with pins 68 extending from the casing 69. These slots extend opposed to each other in the manner shown in Figures 4 and 5 and have open end portions (similar to the slot 53) extending through to the edges of the collar. In this manner, the casing 69 is detachably coupled with the collar which is in turn detachably coupled to the nose piece. The forward edge of the casing 69 provides a bevelled surface 70 which is spaced from the adjacent rear face of the collar.

A chuck member 71 adjacent to the rear end of the casing 69 is formed with an outwardly extending flange portion 72. A cup-shaped member 73 is provided with a forward bead or flange 74, and a piston rod 75 extends outwardly from the base of the cup member 73. A spring 76 is interposed between the flange 72 of the chuck member and the rear end of the casing 69, and the flange 72 is formed with an annular series of perforations which receive a corresponding number of spheres or balls 77. As shown, these elements 77 bear against the outer face of the cup 73 and the inner face of the casing 69, to also engage the bead 74. The openings are tapered in an inward direction so that inward movement of the spheres 77 is limited.

A slidable member preferably embracing a forward section 78, intermediate sections 79, 80 and 81 and a rear section 82, constitute an ampoule receiving chamber. This slidable member might of course be made of a lesser number of sections. However, by providing a plurality of parts, the length of the bore defined may be varied to accommodate ampoules of greater or lesser length. The section 81 has dogs on pawls 81*a* which are

resiliently depressable into recesses in the section 82. The slidable member is encircled by a tube 83 carried by the nose piece 64. The forward section 78 of the slidable member conveniently presents a transverse partition 84 provided with a passage 85 the area of which may be varied by projecting and retracting a screw 86 functioning as a valve. Extending from the inner face of the partition 84 is a piercing needle 87. Extending from the opposite face of that partition is a mounting portion supporting the hub of a needle 88. The bore of the needle 87, passage 85 and needle 88 are preferably aligned. In any event, they are in communication with each other.

In common with the design of the previously described constructions, it is preferred that the cap 65 provide a safety structure. To this end it underlies the actuating portion 89 of a lever pivotally mounted as at 90 and furnished with a latch portion 91. The latter extends into a groove 92 formed in the nose piece 64. Also extending into this groove are one or more pawl elements 93. It will be apparent that with the cap 65 in position, the actuating portion 89 may not be shifted against the action of its spring. A spring 95 exerting less expansive force than the spring 76 is interposed between the outer end of the nose piece 64 and the partition 84. Conveniently the inner face of the nose piece may be recessed as at 96 to accommodate the end of the spring.

The ampoule for use with an apparatus such as has been shown in Figure 10 has been illustrated in Figure 15 and has its forward end engageable with the needle 87 as it is slipped into the receiving compartment defined by the slidable member. Preferably, and as shown the needle 87 is encircled by a spring 97 offering a minor degree of resistance but nevertheless effective to urge the cap 98, which has been penetrated, in a rearward direction to accordingly shift the body of the ampoule 99. The latter has its rear end open and receives a piston type stopper 100. Adjacent to its forward end, the ampoule is preferably constricted as indicated at 101. As shown, the length of the ampoule is such that it may be effectively housed within the slidable member with the rod 75 in engagement with the rear face of the piston stopper 100. As previously stated, the parts may be reproportioned and the length of the slidable member may be changed to receive ampoules having a lesser or greater length than that illustrated in Figure 15.

Conveniently, at the rear end of the syringe, a safety catch is provided. As shown, this will prevent a forward or projecting movement on the part of the chuck assembly and the mechanisms associated therewith. Such catch may take one of numerous different forms. As shown, it comprises a knob 102 rotatably mounted adjacent to the outer rear face of the casing 69 and provided with a stem 103 extending through an opening in that rear wall and an opening in the adjacent wall of the cup-shaped member 73. Secured to its inner end is a cam 104 which rotates as a unit with the stem and enters through the latter opening. A detent structure may be provided by employing a spring 105 secured to the inner face of the cap 102 and bearing into a recess 107 formed in the end wall of the casing. When this spring thus bears, an accidental rotation of the parts will be prevented and the assembly engaged by the cam 104 will be secured against movement. However, by simply turning the cap 102, the cam may be shifted to released position.

Assuming that such shifting has occurred and the parts are assembled in the manner shown in Figure 10, then it will be appreciated that an operator may use the apparatus by simply removing the cap 65 and disposing the outer end of the nose piece 64 in engagement with the epidermis overlying the tissues to receive the injection. If now the actuator 89 is rocked about its pivot 90, the latch 91 will be released from the groove 92. With such release the slidable member 78—81 will be projected under the influence of the spring 76. This will occur because the spring is bearing against the flange 72 and is in a compressed condition. The clutch structure provided by the balls or corresponding elements 77 will thrust against the cup member 73 and especially the bead portion 74 thereof. That bead portion being in line with dogs 81*a*, this thrust will be transmitted to the section 81. These dogs or pawls forming parts of the sliding member assembly, that member will be shifted to the left as viewed in Figure 10. The initial phase of shifting will result in projection of needle 88 so that the epidermis is pierced, and, with continued projection, the needle will penertate the tissues to the desired depth.

Outward movement of the sliding member is of course arrested by the forward end of the same moving to a point in contact with the rear face of the outer wall of the nose piece 64. During the projection of the sliding member the spring 95 will have been compressed. Simultaneously with the needle reaching its full depth of penetration, the dogs 81*a* will have the cam portions adjacent their outer ends ride into engagement with the rear edge of the tube 83 so as to depress the dogs radially out of engagement with the bead portion 74. This will release the coupling between these dogs and the chuck assembly. Accordingly with the sliding member stationary and projected to a maximum extent, that chuck assembly may continue to move under the action of the spring 76.

With the chuck assembly free to move with respect to the sliding member it will carry with it rod 75, which, acting against the piston 100, will shift the latter within the body of the

ampoule 99 to thus express medicament through the bores of the needles 87 and 88 and the intervening bore 85 of partition 84. The speed of injection of the medicament will of course have been regulated by, for example, the valve structure provided by the screw-threaded member 86 in co-operation with the bore 85. This co-operation of the parts will continue until substantially all medicament has been discharged. The stopper 100 will have moved to a point adjacent to the constriction 101 of the ampoule and will have shifted the latter against the action of the spring 97. At that instant the flange 72 of the chuck assembly will have reached a point adjacent to the central area of the collar 67. Accordingly, the spherical elements 77 will have ridden over the edge 70. This will render inoperative the clutch structure between the cup 73 and the chuck 71. Therefore, under the influence of the spring 95, the slidable member will now be free to retract thereby withdrawing the needle from the tissues. In such retraction too great a movement relatively to the nose piece will be prevented by the latch 91 and pawls 93 engaging the edge of the groove 92.

With the completion of this sequence of operation, the collar 67 may be rotated to disconnect the casing 69 from the nose piece 64. Due to the spring 97, no difficulty will be experienced in removing the spent ampoule from the bore of the sliding member and replacing the same with a fresh ampoule. By shifting the flange 72 with respect to the cup-shaped member 73, the spheres 77 may be caused to again assume positions to the rear of the bead 74. Therefore, as the dogs 81*a* engage against the forward edge of the cup member 73, they will cause the entire chuck assembly to move rearwardly within the casing 69 to compress the spring 76. This action will continue until the pins 66 and 68 enter the bayonet or other slots provided as part of the collar 67. As the latter is rotated around the axis of the assembly, a camming action is set up such that the parts are drawn into proper positions. During this movement, it is apparent that the rod 75 in engagement with the piston 100 will cause a bodily shifting of the ampoule such that the needle 87 will penetrate the closure 98 and the spring 97 will be compressed. Due to the minor degree of resistance offered by the spring 97, such shifting and penetration will not cause a movement of the piston in the ampoule body. During the final stages of turning of the collar 67, the piston will however be given a slight movement which will result in an expulsion of medicament through the bores of the needles 87 and 88 and the intervening bore 84 so that all air will be voided.

In the structure shown in Figure 11 a cap 108 is preferably employed to protect the nose piece 109. The latter encloses a spring 110 and has secured to it a sleeve 111. That sleeve is provided with a space to accommodate a slidably mounted latch plate 112 provided with an actuator 113. Preferably, and in common with the earlier structures, the extension 113 may bear against the cap 108 so that when the latter is in position, the latch may not be released against the tension of the spring associated with the same. The sleeve 111 is secured by, for example, bolts 114, to a body portion 115 which is in turn attached to a rearwardly extending casing 116. Interposed between the body portion 115 and the sleeve is the end flange of a tube 117 which is thus held in position.

The latter slidably accommodates a bored member 118 within which a unit 119 is secured. The latter is formed with a duct or bore 120 and provides at its outer end a mounting for the hub of a needle 121. Adjacent to its inner end it mounts a piercing needle portion 122. The bore 120 is aligned with the bore of the needle 121 and 122. A valve structure controlling the flow of medicament through these bores is conveniently furnished by adjustably mounting a stem 122^1 on member 118 and having this stem extend through to the bore 120.

Within the rear end of the casing 116 a spring 123 is disposed, the expansive force of which is substantially greater than that of the spring 110 and may in fact be many times greater. This spring 123 has its rear end bearing against the end wall of the casing and its forward end bears against a ring 124. A spring 125 is arranged in advance of the ring 124 and embodies sufficient strength to maintain a sleeve 126 normally spaced therefrom in the manner shown in Figure 11. The sleeve 126 is conveniently formed with a recess 127 which may take the form of an annular depression in its inner face. A clutch assembly including an outer sleeve 128 and an inner cup-shaped member 129 is disposed within the rear end of the casing and provides a stem or rod 130 which bears against the piston stopper 131 of an ampoule 132. The latter, in common with the ampoule shown in Figure 15, preferably has a constricted portion 133 adjacent to its forward end and the open mouth of that latter end is closed by a seal 134. The overall diameter of the ampoule is such that it may be accommodated within the bore of the slidable member 118 and have its forward end disposed adjacent to the rear end of the unit 119.

Adjacent to the rear end of the slidable member 118, there are a series of dogs or pawls 135. These may be secured in any desired position and have their rear ends extending beyond the face of the slidable member 118. To the rear of these dogs, the slidable member may mount a retaining assembly 136. The latter terminates in an aperture member the opening of which has a

diameter less than the diameter of the ampoule 132 but in excess of the rod 130. Accordingly, the ampoule will be retained in association with the slidable member 118 when the closure assembly 136 is in position. Adjacent to the body 115 and mounted preferably by the casing 116, are a series of stops 137. These extend into the path of travel of the collar 126. It will finally be noted in connection with this portion of the assembly that balls 138 are disposed in an annular series of openings formed in the flange 139 of the chuck 128 and that the cup 129 terminates in an outwardly extending flange 140 the diameter of which is such that it would be engaged by the rear end of the pawls 135 when the latter are in their normal position as shown.

Now considering the operation of the apparatus as described and shown with reference to Figure 11, it will be understood that with the parts in the position illustrated and the nose piece 109 exposed, the operator, after bringing that nose piece to the desired position, may press against the actuator 113 to thus align the aperture of the latter with respect to the slidable member 118. Accordingly, the latter is released for movement. Such movement will occur under the action of the spring 123 pressing against the ring 124 to shift the chuck assembly, including the piston 130, to the left as viewed in this figure. The ampoule 132 will be likewise shifted because of the engagement of the pawls 135 with the forward bead of the edge portion 140 of the cup 129. As the needle 121 reaches its fully projected position, the spring 110 will be fully compressed. The rear ends of the pawls 135 will enter the tube 117 and thus be rocked inwardly. Incident to that movement, the chuck assembly will be freed from exerting thrust against the slidable member 118. With such freeing, and under the action of the spring 123, the chuck assembly will be projected with respect to the ampoule thus causing the piston stopper 131 to discharge medicament through the needle portion 122 and so through the bore of the needle 121.

This action will continue until the ring 126 has reached a position in contact with the stops 137. Simultaneously, the stopper 131 will engage with the constriction 133 to arrest movement of the chuck. Thereupon the spring 123 will continue to urge and move the ring 124 and the member 128 with respect to the collar 126. With that shifting, the balls 138 or equivalent members will move into the recess 127. Therefore, they will be retracted from behind the flange 140. Accordingly the clutch structure will become inoperative to cause the spring 123 to retain the sliding member 118 in projected position. Under these circumstances, the spring 110 will shift that member together with the needle 121 and the associated parts rearwardly. This will withdraw the hypodermic needle from the tissues after the completion of the injection stroke.

The couplings between the bolts providing the stops 137 and sleeve 111 may comprise bayonet slots 141 or slots which have openings terminating in the edge portion of one of the parts of the assembly. Of course other coupling means might be employed. In any event after the operation of the apparatus as afore described, the casing 116 is detached from the parts associated with the nose piece. The spent ampoule 132 is withdrawn by dismounting the outer element of the assembly 136, and a new ampoule is placed in position. The re-establishment of the clutch portions involving the chuck assembly, the collar 126 and associated parts is re-established by gravity, manually shifting the parts or otherwise in the same manner as in the case of the mechanism shown in the preceding figures. Now, as the casing 116 is again connected to the nose piece, the ends of the pawls or dogs 135 will bear against the flange 140 of the cup 129 and force the same rearwardly together with the flange 139 of the member 128. This will result in a similar movement on the part of the ring or collar 124. Accordingly, the spring 123 will be compressed. This compression will continue until the final stages of tightening of the parts at which time these parts should be positioned in a manner such that the piston rod 130 will project the piston stopper 131 to a slight degree such that air within the bores of the needle is voided and these bores are filled with liquid medicament.

When the apparatus is not in use, sterilisation of the parts may be maintained by placing any suitable quantity of liquid such as alcohol or suitable fluid vapour within the mechanism. To this end, and as shown especially in Figures 11 and 9 enclosing caps or shields 142 may be applied. As previously stated the ampoule shown in Figure 8 is primarily the type for employment in connection with the mechanism shown in Figures 1 to 3 inclusive. The ampoule shown in Figure 13 is of the type primarily intended in use in connection with the apparatus as shown in Figure 9. The ampoule of Figure 13 corresponds to the one shown in the assembly in Figure 10, and by modifying the length of the same furnishes an ampoule suitable for use in mechanisms such as are shown in Figure 11. The ampoules illustrated in Figures 12 and 14 exemplify structures which are suitably modified according to the needs of the manufacturer but which will still achieve the functional results desired.

What I claim is:—

1. A hypodermic injection apparatus, in which a hypodermic needle and a medicament-containing member operatively connected with each other are mounted on supports within and movable with respect to the body of the apparatus, power means supported by the

body being connectable with the said supports by a coupling assembly including clutch mechanism for moving the supports to cause the said needle to project beyond a predetermined point, and releasable means being provided for preventing the said movement of the supports.

2. A hypodermic injection apparatus according to claim 1, in which means are provided for causing expulsion of medicament from the said medicament-containing member through the needle when the needle has been projected.

3. A hypodermic injection apparatus according to claim 2, in which means are provided for retracting the support for the needle substantially simultaneously with the completion of expulsion of medicament.

4. A hypodermic injection apparatus according to claim 1, in which the hypodermic needle is carried by one of the said supports and the medicament-containing member is mounted on another of the said supports, means forming part of the coupling assembly being co-operative with the medicament-containing member to expel medicament through the said needle, means being co-operative with the support for the needle to limit the projection of the needle, and means being co-operative with the said clutch mechanism for disconnecting the needle support from the power means substantially simultaneously with the limiting of projection of the needle support.

5. A hypodermic injection apparatus according to claim 4, in which the medicament expelling means is operated by the said power means substantially simultaneously with the limiting of projection of the needle support.

6. A hypodermic injection apparatus according to claim 4 or claim 5, in which the said clutch mechanism comprises a primary clutch and a secondary clutch, the primary clutch being operatively connected to the needle support and the secondary clutch being provided for connecting the medicament expelling means with the said power means, and means being provided for disconnecting the said second clutch substantially simultaneously with the completion of expulsion of medicament from the medicament-containing member.

7. A hypodermic injection apparatus according to claim 6, in which means are provided for causing retraction of the needle support upon completion of the expulsion of medicament from the medicament-containing member.

8. A hypodermic injection apparatus according to claim 6, in which a second power means is rendered operative by the first mentioned power means, means being provided for releasing the said second power means to retract the needle support substantially simultaneously with the completion of the expulsion of medicament.

9. A hypodermic injection apparatus according to claim 1 or claim 2, in which medicament expelling means is movable with respect to the said medicament-container supporting means to cause expulsion of medicament from the medicament-containing member, the coupling assembly being adapted to cause the power means to initially project the supporting means and subsequently move the medicament-container supporting means alone, and means forming part of the coupling assembly being operative to successively disconnect the power means from the needle supporting means and the medicament-container supporting means.

10. A hypodermic injection apparatus according to claim 1, in which the power means comprises an expansible thrust member, clutch mechanism being provided for connecting the said thrust member with the support for the hypodermic needle to project the said support and to cause the hypodermic needle to extend beyond the said body, means being provided for causing expulsion of medicament from the medicament-containing member through the said needle, mechanism being provided for automatically operating the said clutch mechanism to disconnect the expansible thrust member from the support upon the latter having been projected to a pre-determined extent and to operatively couple the thrust member to the expulsion means, further means being operative to disconnect the expulsion means from the thrust member and means being operative thereafter for causing retraction of the said support.

11. A hypodermic injection apparatus according to claim 10, in which manually controlled mechanism is provided for releasing the said thrust member to allow it to expand.

12. A hypodermic injection apparatus according to claim 10, in which a second expansible thrust member of less power than the first mentioned thrust member is mounted on the body of the apparatus, the said support being connected with the second thrust member whereby upon the support being projected the said second thrust member will be compressed and the clutch mechanism will release the second thrust member for expansion to cause retraction of the support and the needle carried thereby.

13. A hypodermic injection apparatus according to claim 10, in which a spring carried by the body of the apparatus is connected with the said support so as to be compressed as the support is projected, the said clutch mechanism being operative to release the said spring for expansion to cause retraction of the support and the needle carried thereby.

14. A hypodermic injection apparatus according to claim 1, in which manually con-

trolled means is operable to release the said support for movement, a cap being mounted on the said body such that when so mounted the cap obstructs the said manually controlled means to prevent release of the support.

15. In a hypodermic injection apparatus according to claim 1, which in response to manual release of its mechanism causes projection of a hollow needle to embed the same in tissue and a subsequent discharge of medicament through the bore of said needle, in combination a movable needle support, expansible power means, means for causing a discharge of medicament and a clutch, said clutch being connected to said power means and said support to project the latter, means co-operating with said clutch to release the same from an operative connection with said support and means whereby said clutch after such release connects said power means to operate said medicament-discharging means.

16. In a hypodermic injection apparatus according to claim 1, which in response to a manual release of its mechanism causes projection of a hollow needle to embed the same in tissue and subsequent discharge of medicament through the bore of said needle and final retraction of said needle, in combination a movable needle support, expansible power means, and means for causing a discharge of medicament, the clutch mechanism comprising a primary clutch and a secondary clutch, the primary clutch being connected to the power means and said needle support to project the latter, means co-operating with the primary clutch to release the same from operative connection with said support, and after said release the secondary clutch being operative to cause the power means to operate said medicament-discharging means and means for thereupon disengaging the secondary clutch to permit retraction of the said needle support.

17. A hypodermic injection apparatus according to claim 16, in which the said needle support compresses a second expansible power means during projection of the support, the said secondary clutch being disengaged to permit the second power means to retract the said support upon completion of medicament discharge.

18. In a hypodermic injection apparatus according to claim 1, which in response to manual release of its mechanism causes projection of a hollow needle to embed the same in tissue and subsequent discharge of medicament through the bore of said needle, in combination a movable needle support, expansible power means, a clutch movable within said apparatus, piston means connected to move with said support, a second support for a medicament-carrying member to be disposed in operative association with said piston means, said clutch being connected to said power means and the needle support to project the latter, means, co-operating with said clutch to release the same from operative connection with the needle support and means whereby said clutch after such release is operative to connect said power means with said second support to shift the latter with respect to said piston means to cause expulsion of medicament from a member carried by said second support.

19. In a hypodermic injection apparatus according to claim 1, which in response to manual release of its mechanism causes projection of a hollow needle to embed the same in tissue and subsequent discharge of medicament through the bore of said needle, in combination a movable needle support, expansible power means, piston means connected to move with said power means, means for retaining a medicament-containing member in association with said support and operatively disposed with respect to said piston means, a clutch connecting said power means with said support for projecting the latter, means co-operating with said clutch to release the same for operative connection with said support and means whereby said clutch after such release causes said power means to project said piston means with respect to said support to cause an expulsion of medicament from a member associated therewith.

20. A hypodermic injection apparatus according to claim 1, having its parts constructed and arranged substantially as described with reference to Figures 1 to 3, or Figure 9 or Figure 10 or Figure 11 of the accompanying drawings.

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Fig. 1

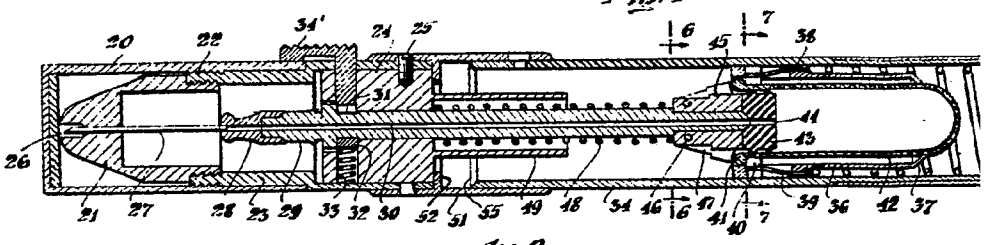


Fig. 2

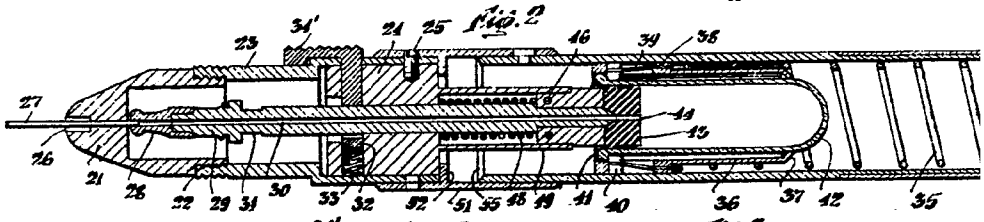
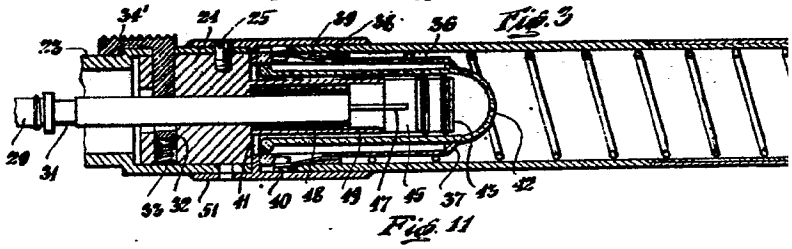


Fig. 3



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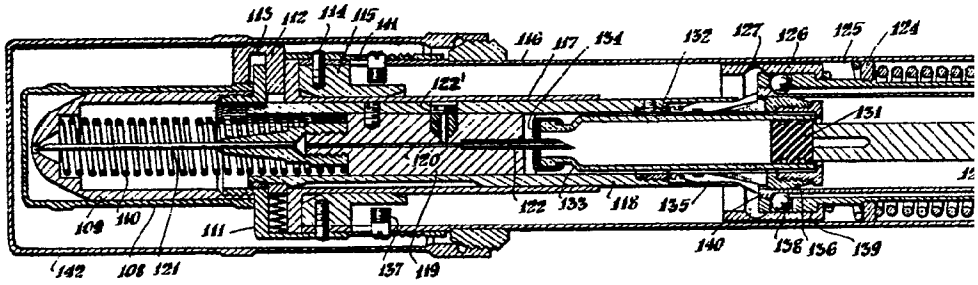

Fig. 10

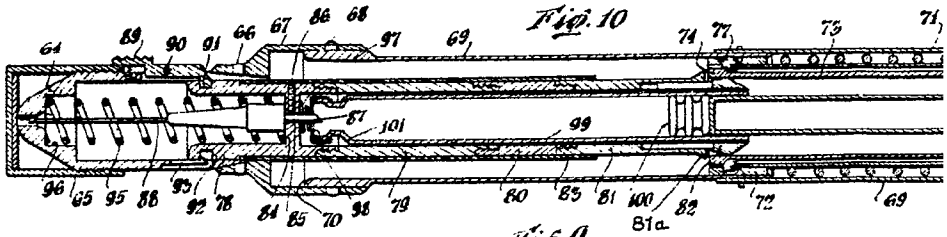

Fig. 9

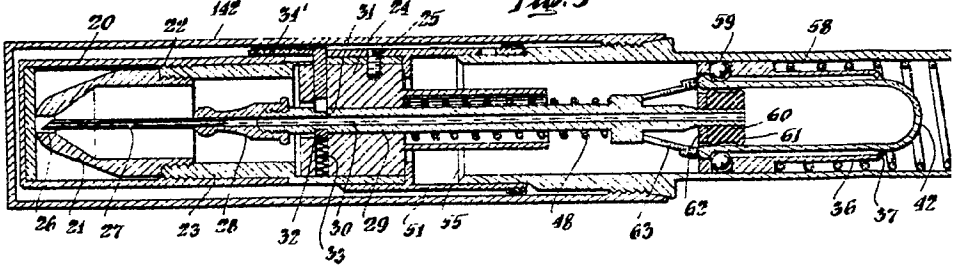

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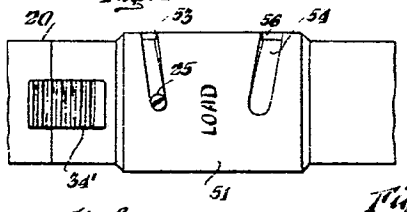
Fig. 4



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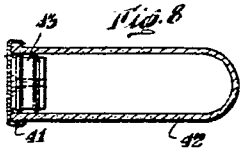


Fig. 6

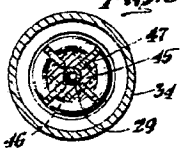


Fig. 5

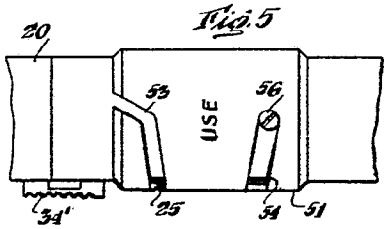


Fig. 7

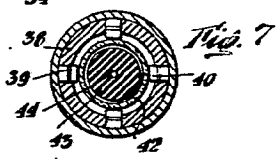


Fig. 12

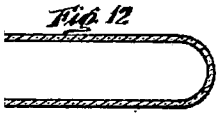


Fig. 13

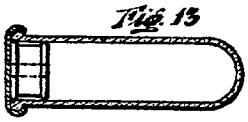
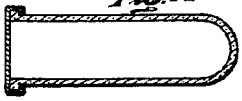


Fig. 14



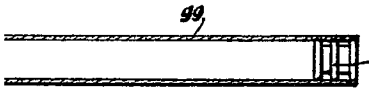


Fig. 15

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